

COUNTRY ANALYSIS BRIEFS

India

Last Updated: March 2009

Background

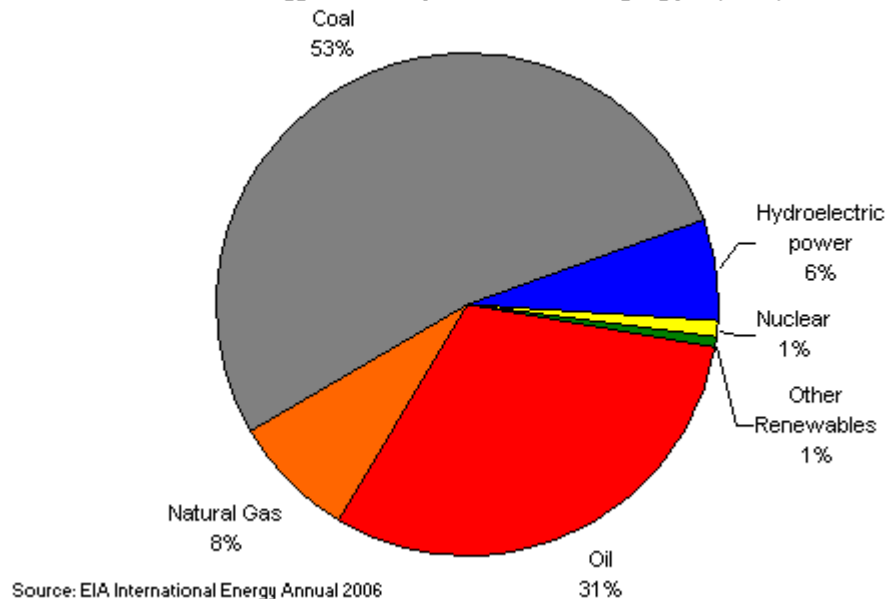
India boasts a growing economy, and is increasingly a significant consumer of oil and natural gas.

With high rates of economic growth and over 15 percent of the world's population, India has become a significant consumer of energy resources. In 2006, India was the sixth largest oil consumer in the world. The global financial crisis and credit crunch have slowed India's significant economic growth particularly in the manufacturing sector, and GDP growth rates have declined from 9.3 percent in 2007 to 5.3 percent in the fourth quarter of 2008. Despite a recent slowing economy, India's energy demand continues to increase. In terms of end-use, energy demand in the transport sector is expected to be particularly high, as vehicle ownership, particularly of four-wheel vehicles, is forecast to increase rapidly once the global economic crisis abates and domestic spending levels resume.



India lacks sufficient domestic energy resources and must import much of its growing energy requirements. India is not only experiencing an electricity shortage but is also increasingly dependent on oil imports to meet demand. In addition to pursuing domestic oil and gas exploration and production projects, India is also stepping up its natural gas imports, particularly through imports of liquefied natural gas. The country's ability to secure a reliable supply of energy resources at affordable prices will be one of the most important factors in shaping its future energy demand.

Coal accounts for more than half of India's total energy consumption followed by oil, which comprises 31 percent of total energy consumption. Natural gas and hydroelectric power account for 8 and 6 percent of consumption, respectively. Although nuclear power comprises a very small percentage of total energy consumption at this time, it is expected to increase in light of recent international civil nuclear energy cooperation deals. According to the Indian government, 30 percent of India's total energy needs are met through imports.

Total Energy Consumption in India, by Type (2006)

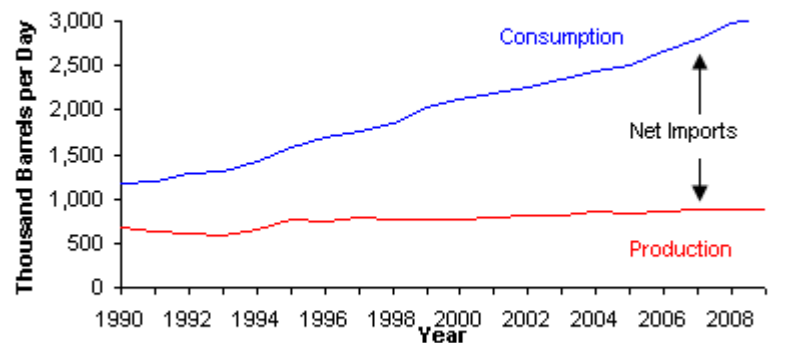
Oil

Because India is a growing net importer of oil, the Indian government has held several licensing rounds in an effort to promote exploration activities and boost domestic oil production.

According to *Oil & Gas Journal (OGJ)*, India had 5.6 billion barrels of proven oil reserves as of January 2009, the second-largest amount in the Asia-Pacific region after China. India's crude oil reserves tend to be light and sweet, with specific gravity varying from 38° API in the offshore Mumbai High field to 32° API at other onshore basins.

India produced roughly 880 thousand bbl/d of total oil in 2008, of which approximately 650 thousand bbl/d was crude oil, with the rest of production resulting from other liquids and refinery gain. India has over 3,600 operating oil wells, according to *OGJ*. Although oil production in India has slightly trended upwards in recent years, it has failed to keep pace with demand and is expected by the EIA to decline slightly in 2009.

India's oil consumption has continued to be robust in recent years. In 2007, India consumed approximately 2.8 million bbl/d, making it the fifth largest consumer of oil in the world. Demand grew to nearly 3 million bbl/d in 2008. EIA anticipates consumption growth rates flattening in 2009 largely due to slowing economic growth rates and the recent global financial crisis.

India's Oil Production and Consumption 1990-2009*

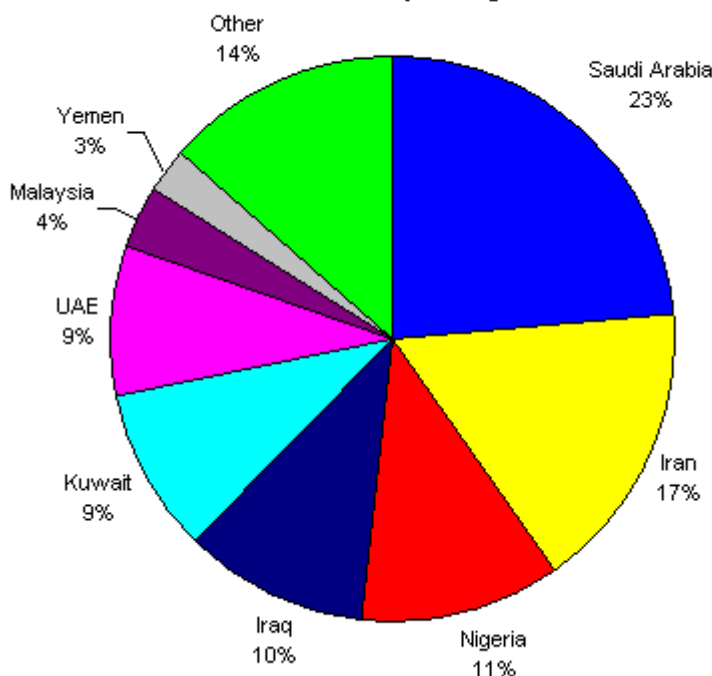
Source: U.S. Energy Information Administration

The combination of rising oil consumption and relatively flat production has left India increasingly dependent on imports to meet its petroleum demand. In 2006, India was the seventh largest net importer of oil in the world. With 2007 net imports of 1.8 million bbl/d, India is currently dependent

on imports for 68 percent of its oil consumption. The EIA expects India to become the fourth largest net importer of oil in the world by 2025, behind the United States, China, and Japan.

The government of India's largest crude oil import partner is Saudi Arabia, followed by Iran. Nearly three-fourths of India's crude oil imports come from the Middle East. The Indian government expects this geographical dependence to rise in light of limited prospects for domestic production.

India's Crude Oil Imports by Source, 2007



Source: World Trade Atlas

Sector Organization

India's oil sector is dominated by state-owned enterprises, although the government has taken steps in recent years to deregulate the hydrocarbons industry and encourage greater foreign involvement. India's state-owned Oil and Natural Gas Corporation (ONGC) is the largest oil company. ONGC is the dominant player in India's upstream sector, accounting for roughly 71 percent of the country's oil production in 2007, according to Indian government estimates. State-owned Oil India Limited (OIL) is the next largest oil producer, having accounted for approximately 28 percent of oil production during the same year. Other major state-run players include the Indian Oil Corporation (IOC) and the Gas Authority of India Limited (GAIL), although these companies are primarily involved in downstream activities such as petroleum refining and gas pipelines and distribution, respectively. In addition, the private Indian firm, Reliance Industries Limited, is also becoming a significant operator in the oil sector and is the largest private oil and gas company in the country. Cairn India, a branch of UK-based Cairn Energy, and BG Exploration are also important private sector operators in the industry.

As a net importer of oil, the Indian government has introduced policies aimed at increasing domestic exploration and production (E&P) activities. Economic reform and other efforts to open up the country have led to increased foreign investment in India. As part of an effort to attract oil majors with deepwater drilling experience and other technical expertise, the Ministry of Petroleum and Natural Gas created the New Exploration License Policy (NELP) in 2000, which for the first time permitted foreign companies to hold 100 percent equity ownership in oil and natural gas projects. International oil and gas companies operate only a relatively small number of fields at this time, however.

India's downstream sector is also dominated by state-owned entities, although private companies have increased their market share in recent years. The Indian Oil Corporation (IOC) is the largest state-owned company in the downstream sector, operating 10 of India's 18 refineries and controlling about three-quarters of the domestic oil pipeline transportation network. Reliance Industries, a private Indian firm, opened India's first privately-owned refinery in 1999, and has gained a considerable market share in India's oil sector.

Exploration and Production

Most of India's crude oil reserves are located offshore, west of the country, and onshore in the northeast, although substantial newly-discovered reserves are located offshore in the Bay of Bengal and in Rajasthan state. India's largest oil field is the offshore Mumbai High field, located north-west of Mumbai and operated by ONGC. Although production has declined at Mumbai High, it still produces nearly 300,000 bbl/d. Another of India's large oil fields is the Krishna-Godavari basin, located in the Bay of Bengal. Block D6 in the Krishna-Godavari basin, operated by Reliance Industries, could account for as much as 40 percent of India's current domestic hydrocarbon output when production peaks. Oil production from this block began in September 2008. Onshore, GAIL is planning to invest \$18 million in exploratory drilling in Assam State, an important location for oil reserves. ONGC also plans to invest as much as \$2.4 billion in exploratory work in the northeast, particularly in Mizoram, Tripura, and Nagaland states.

In light of declining production at the majority of India's fields, companies are investing in enhanced oil recovery methods. ONGC plans to invest nearly \$1.5 billion in such projects, and a multitude of these schemes have been approved for many of the company's fields.

To help meet growing oil demand and support the country's energy security, India has promoted various E&P projects in an effort to boost domestic oil production. However, new E&P projects are expected to be difficult due to their deepwater location or terrain type. In order to address these challenges, Indian companies are recruiting foreign firms with greater experience and more sophisticated technology. For example, ONGC recently assigned a participating interest to Rocksource ASA, a Norwegian company with technological expertise in deepwater drilling, and to Petrobras for the development of an eastern offshore deepwater block. The participation of private foreign firms over the last five years has helped develop previously unexploited deepwater areas and allow India to tap more of its domestic oil resources.

The primary mechanism through which the Indian government has promoted new E&P projects has been the NELP framework. The latest round of auctions, NELP VII, has been less successful than the government expected and with interest stemming largely from domestic firms rather than foreign investors. India plans to launch the NELP VIII bidding round in mid-March 2009.

Overseas E&P

In recent years, Indian NOCs have increasingly looked to acquire equity stakes in E&P projects overseas. The most active company abroad is ONGC Videsh Ltd (OVL), the overseas investment arm of ONGC. ONGC Videsh conducts oil and natural gas operations in 13 countries, including Vietnam, Myanmar, Russia (Sakhalin Island), Iran, Iraq, Sudan, Brazil, and Columbia. One of ONGC Videsh's most high profile investments is its share in the Greater Nile Petroleum Operating Company (GNPOC), which has engaged in E&P work in Sudan since 1997. ONGC Videsh acquired a 25 percent equity stake in the company in 2003, with the balance held by the China National Petroleum Company (CNPC, 40 percent), Petronas (30 percent), and the Sudan National Oil Company (Sudapet, 5 percent). The GNPOC acreage in Sudan holds proved crude oil reserves of more than one billion barrels with current production levels at roughly 300,000 bbl/d from 10 fields. In addition to the upstream activities, the GNPOC companies operate a 935-mile crude oil pipeline that pumps oil to Port Sudan for export (see the [Sudan Country Analysis Brief](#) for more information).

ONGC Videsh also holds a 20 percent stake in the ExxonMobil-led consortium that operates the Sakhalin-I project in Russia. According to company estimates, the oil fields associated with Sakhalin-I hold recoverable crude oil reserves of 2.3 billion barrels. For more information on the Sakhalin-I project, please see the [Russian CAB](#).

In addition to ONGC, other Indian companies are also actively involved in E&P projects abroad. OIL, for example, is working on projects in Libya, Gabon, Nigeria, and Sudan, and IOC, GAIL, and Reliance are also pursuing overseas oil E&P assets.

Downstream/Refining

According to OGJ, India had 2.26 million bbl/d of crude oil refining capacity at 18 facilities as of January 2008. The country has the eighth largest refinery capacity in the world. This year, privately-owned Reliance Industries surpassed state-owned India Oil Corporation (IOC) in terms of refining capacity in the country due to additions to its recently upgraded facility. Reliance's only refinery, the Jamnagar facility, is India's largest, with an initial capacity of 660,000 bbl/d. Reliance recently enlarged the Jamnagar site to add an additional capacity of 580,000 bbl/d, making it the largest refining complex in the world with a refining capacity of 1.24 million bbl/d.

Other key upcoming refinery projects include Essar Oil's Vadinar refinery expansion of 110,000 bbl/d in 2010 and 320,000 bbl/d in 2013, IOC's Paradeep refinery expansion of 300,000 bbl/d in 2014, and 300,000 bbl/d capacity additions to refineries in Bina and Bhatinda by 2013. India is slated to add 1.6 million bbl/d of refining capacity through 2015 based on current proposed projects.

Due to expectations of high demand for petroleum products in the region, further investment in the Indian refining sector is likely. As part of the country's 11th Five Year plan from 2007 to 2012, the government would like to promote India as a competitive refining destination, and industry experts expect the country to be a significant exporter of refined products to Asia in the near future. The remaining challenge for the country will be to obtain a secure supply of crude oil to feed its refineries.

Refined Fuel Subsidies

Beginning in 2002, the Indian government introduced some measures aimed at deregulation in the downstream oil sector. Private refiners may now directly market some of their own petroleum products to their customers. Additionally, the government phased out the Administered Price Mechanism (APM) on oil products in 2002, replacing it with the new Market Determined Price Mechanism (MDPM). However, while the MDPM is notionally benchmarked to international oil prices, the Indian government continues to heavily subsidize domestic prices of oil products such as diesel, LPG, and kerosene for consumers. As such, demand for petroleum products in India has been substantially influenced by the government's pricing scheme. With diesel prices significantly lower than other fuels, such as gasoline, demand for diesel rose substantially, by as much as 25 percent between 2006 and the first half of 2008, according to industry analysts.

The combination of high international crude oil prices and low domestic fuel rates before the fourth quarter of 2008 led private refiners in the country, particularly Reliance and its Jamnagar facility, to have an overt export focus in order to avoid suffering significant financial losses in the domestic market. Although partial compensation in the form of oil bonds has been extended to ease the financial burden imposed by capped fuel prices to the three state-owned retailers IOC, Hindustan Petroleum (HPCL), and Bharat Petroleum (BPCL), the private refiners have not received the same government support. Upstream firms such as ONGC also subsidized about one-third of state refiners' revenue losses through discounts on crude sales. The government pushed through small domestic fuel price increases, as the price of petroleum products rose by 15 percent in the first half of 2008, according to industry reports, but rates remained well below competitive international levels. The rate hikes have had little effect on rising demand for diesel fuel and have not entirely closed the losses incurred by Oil Marketing Companies (OMCs). Because of a reversal in crude oil prices from all-time highs in July 2008 and a desire to stimulate the domestic economy, the Indian government cut retail prices in December 2008 and January 2009 by approximately 12 percent for diesel and over 20 percent for gasoline.

Strategic Petroleum Reserve

In support of the country's energy security, Indian officials have declared that the country intends to develop a strategic petroleum reserve (SPR). The decision has been made to set up a strategic reserve of 5 million tons (36.6 million barrels) of crude oil in underground structures in Mangalore, Visakhapatnam, and Padur. The project is expected to come online in 2012. The location of the storage facilities was selected to be along the coast so that the reserves could be easily transported to refineries during a supply disruption. The SPR project is being managed by the Indian Strategic Petroleum Reserves Limited (ISPRL), which is part of Oil Industry Development Board (OIDB), a state-controlled organization. Despite these plans, India does not have any strategic crude oil stocks at this time.

Natural Gas

Despite major new natural gas discoveries in recent years, India is considering large-scale imports via pipelines and LNG terminals to help meet growing demand.

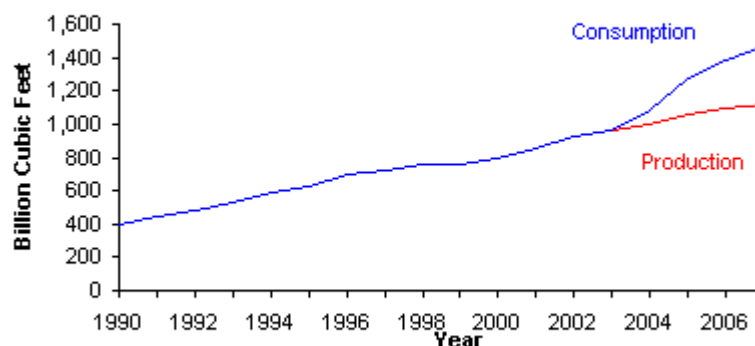
According to Oil and Gas Journal (OGJ), India had 38 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2009. The EIA estimates that India produced approximately 1.1 Tcf of natural gas in 2007, up only slightly from 2006 production levels. The bulk of India's natural gas production comes from the western offshore regions, especially the Mumbai High complex. The onshore fields in Assam, Andhra Pradesh, and Gujarat states are also significant sources of natural gas. The Bay of Bengal has also become an important source of natural gas for the country.

In 2007, India consumed roughly 1.5 Tcf of natural gas, approximately 100 Bcf more than in 2006, according to EIA estimates. Natural gas demand is expected to grow considerably, largely driven by demand in the power sector. The power and fertilizer sectors account for nearly three-quarters

of natural gas consumption in India. By 2030, EIA expects Asian demand for natural gas to more than double, and India is expected to be responsible for a sizeable part of that growth. Natural gas is expected to be an increasingly important component of energy consumption as the country pursues energy resource diversification and overall energy security.

Although India's natural gas production has consistently increased, demand has already exceeded supply and the country has been a net importer of natural gas since 2004. India's net imports reached an estimated 353 Bcf in 2007. India imports natural gas via liquefied natural gas (LNG).

**India's Natural Gas Production and Consumption
1990-2007**



Source: U.S. Energy Information Administration

Sector Organization

As in the oil sector, India's state-owned companies account for the bulk of natural gas production. State-run companies ONGC and Oil India Ltd. (OIL) are the main producers of natural gas in the country. According to government statistics, ONGC accounted for 69 percent of natural gas production in the country in 2007. In addition, some foreign companies participate in upstream developments in joint-ventures and production sharing contracts (PSCs). Privately-owned Reliance Industries will also have a greater role in the natural gas sector in the coming years, as a result of a large natural gas find in 2002 in the Krishna-Godavari basin.

Natural gas prices in India are also regulated by the government. Natural gas produced by state-owned companies is sold in accordance with the Administered Pricing Mechanism (APM). Gas produced from fields acquired through NELP, production sharing agreements, and imported LNG is not priced using the APM, although its price is also regulated.

The Gas Authority of India Ltd. (GAIL) holds an effective monopoly on natural gas transmission and distribution activities. In December 2006, the Minister of Petroleum and Natural Gas issued a new policy that allows foreign investors, private domestic companies, and national oil companies to hold 100 percent equity stakes in pipeline projects. While GAIL's monopoly in natural gas transmission and distribution is not guaranteed by statute, it will continue to be the leading player in the sector because of its existing natural gas infrastructure. The country has a number of major domestic pipelines in its domestic transmission network with ambitious plans to extend them further. GAIL's current natural gas trunk pipeline network extends roughly 4,100 miles, according to the company and, according to PFC Energy, the Government of India plans to spend about \$9 billion to upgrade the transmission network and extend the system.

Exploration and Production

While India is not expected to be a significant contributor to the upstream oil sector, the outlook for the upstream natural gas sector is more positive, although the IEA forecasts that natural gas production in India will peak between 2020 and 2030. Most natural gas production in India comes from fields off the western coast, including the Mumbai High complex and the Tapti, Panna, and Mukti fields, while the major onshore fields are located in the northeast, in the areas of Assam, Andhra Pradesh, and Gujarat. The Bay of Bengal has also recently become an important area of reserves, in particular in the Krishna-Godavari basin. GAIL recently announced plans to invest \$35 million in exploration and production projects in northeastern areas of the country, particularly in Assam, which are likely to be difficult to develop due to the terrain and increasing violence from separatist rebels. In addition, ONGC formed plans to invest \$2.4 billion for E&P oil and gas

projects in the same region.

There have been some large natural gas finds in India over the last several years, predominantly offshore in the Bay of Bengal. In December 2006, ONGC announced that it had found an estimated 21 to 22 Tcf of natural gas in place at the KG-DOWN-98/2 block off the coast of Andhra Pradesh in the Krishna Godavari basin. In addition, in August 2008, the company made four new finds in the GS-15-OA block in the same basin. ONGC also announced another find in 2006 in the Mahanadi basin off the coast of Orissa state, with an estimated 3 to 4 Tcf reserves in place. These discoveries fit into the recent trend of large upstream developments in the Bay of Bengal, especially in the Krishna Godavari basin. In addition, state-owned Gujarat State Petroleum Corporation (GSPC) holds an estimated 1.8 Tcf of natural gas reserves at the KG-OSN-2001/3 block in the Krishna Godavari area, a substantial holding for the company.

Another key find is Reliance Industries' D-6 block in the Krishna-Godavari basin, which holds estimated reserves of 11.5 Tcf. Natural gas production in this field began in late 2008. Reliance and its equity partner Niko Resources have reportedly invested \$8.7 billion in the deepwater project, which is expected to supply 2.8 Bcf/d of natural gas at its peak. In order to transport the gas throughout the country, GAIL has recently completed a pipeline linking the Krishna-Godavari basin with existing gas transport infrastructure. The finds in the Krishna-Godavari basin are expected to double the country's current natural gas output in coming years.

Companies are working to produce as much as possible domestically from current fields due to the widening supply and demand gap. ONGC has worked to maximize its recovery rate at the Mumbai High structure, which supplies the bulk of the country's natural gas at present, and is investing in facilities to develop its marginal fields. BG International and Reliance Industries are also jointly working to expand production at the Tapti, Panna, and Mukti fields in the Mumbai High basin. Despite these large finds, natural gas demand in India is expected to outstrip new supply in the years ahead.

Natural Gas Imports

Analysts expect that India's natural gas import demand will increase in the coming years. To help meet this growing demand, a number of import schemes including both LNG and pipeline projects have either been implemented or considered.

Iran-Pakistan-India Pipeline

India has considered various proposals for international pipeline connections with other countries. One such scheme is the Iran-Pakistan-India (IPI) Pipeline, which has been under discussion since 1994. The plan calls for a roughly 1,700-mile, 5.4-Bcf/d pipeline to run from the South Pars fields in Iran to the Indian state of Gujarat. While Iran is keen to export its abundant natural gas resources and India is in search of projects to meet its growing domestic demand, a variety of economic and political issues have delayed a project agreement. Indian officials have made it clear that any import pipeline crossing Pakistan would need to be accompanied by a security guarantee from officials in Islamabad. Apart from security concerns, natural gas pricing disputes have also held up an agreement. Both Indian and Pakistani officials refused Iran's proposed price of \$8.00 per million Btu (MMBtu), stating that they would not pay more than \$4.25/MMBtu. Due to the uncertainties involving this pipeline, the Indian government's 11th Five Year plan does not project any gas supply from this route or the following two discussed pipelines (see the [Iran Country Brief](#) for more information).

Turkmenistan-Afghanistan-Pakistan-India Pipeline

India has worked to join onto the Turkmenistan-Afghanistan-Pakistan Pipeline (TAP or Trans-Afghan Pipeline). With the inclusion of India, the project consists of a planned 1,050-mile pipeline originating in Turkmenistan's Dauletabad natural gas fields and transporting the fuel to markets in Afghanistan, Pakistan, and India. In 2008, all parties agreed to induct India as a full member into the project, thereby renaming the pipeline TAPI. TAPI will have a capacity of 3.2 Bcf/d and work is expected to commence in 2010, with supplies scheduled to flow in 2015. Concerns about the project have included the security of the route, which would traverse unstable regions in Afghanistan and Pakistan. Furthermore, a review of the TAPI project raised doubts about whether Turkmen natural gas supplies are adequate to meet proposed export commitments.

Imports from Myanmar

A third international pipeline proposal envisions India importing natural gas from Myanmar. In March 2006, the governments of India and Myanmar signed a natural gas supply deal, although a specific pipeline route has yet to be determined. Initially, the two countries planned to build a pipeline that would cross Bangladesh. However, after indecision from Bangladeshi authorities

over the plans, India and Myanmar have studied the possibility of building a pipeline that would terminate in the eastern Indian state of Tripura and not cross Bangladeshi soil. A proposal to build a pipeline between Myanmar and China may interrupt India's pipeline plans, however.

India is working to enhance its presence in Myanmar in light of its neighbor's large natural gas reserves. Both GAIL and ONGC are investing large sums to obtain access to blocks of the Swe field containing 200 billion cubic meters (7 Tcf). India recently signed a deal to build two hydroelectric power plants in Myanmar, largely perceived as an effort to boost relations between the two countries and enable further gas supply deals.

Liquefied Natural Gas

India began importing liquefied natural gas (LNG) in 2004. In 2006, India imported 254 Bcf of LNG, making it the seventh largest importer of LNG in the world. India's LNG imports in 2006 came from Algeria, Egypt, Nigeria, Oman, Qatar, United Arab Emirates, Australia, and Malaysia. Qatar was by far the largest supplier in 2006, accounting for nearly 86 percent of imports. India imports LNG through both long-term contracts and spot shipments.

Currently, India has two LNG import terminals, with several others that are planned or proposed. India started receiving LNG shipments in January 2004 with the start-up of the Dahej terminal in Gujarat state. Petronet LNG, a consortium of state-owned Indian companies and international investors, owns and operates the Dahej LNG facility with a capacity of 5 million tons per year (mta) (975 bcf/y). India's second terminal, Hazira LNG, started operations in April 2005, and is owned by a joint venture of Shell and Total. The facility has a capacity of 2.5 mta (488 Bcf/y), which may be expanded to 5 mta (975 Bcf/y) in the future.

In addition, Petronet LNG is currently finalizing a deal with a Japanese consortium to build a 2.5 mta (488 Bcf/y) LNG import facility at Kochi. The project is expected to cost US\$500 million and is partially funded by the International Finance Corporation. The facility is expected to be completed in March 2012 and will potentially be expanded to a capacity of 5 mta (975 Bcf/y). Petronet LNG plans to sign a long-term LNG supply deal with Australia's Gorgon LNG project for 2.5 mta (488 Bcf/y) in early 2009.

Another proposed LNG facility is the 5 mta (975 Bcf/y) LNG processing plant in Dabhol. Following delays in the plant's early stages, the Ratnagiri Gas and Power Company purchased the Dabhol Power Company in 2005. Dabhol is currently operating a power plant, but the LNG receiving terminal is not scheduled to begin operations until the first half of 2009. In addition, several other companies are studying possible LNG import sites around India, such as GAIL's Ennore LNG terminal at Tamil Nadu, scheduled for commissioning in 2011.

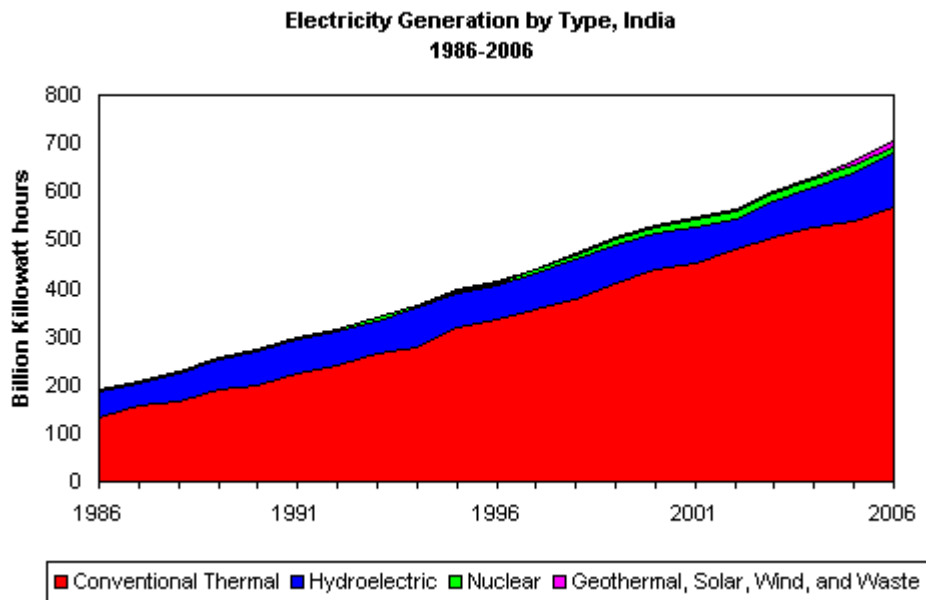
In order to secure supply of natural gas to India and meet growing demand, India is currently looking to invest in liquefaction projects abroad. For example, ONGC and the UK-based Hinduja Group are considering service contracts in Iran to supply 5 mta (975 Bcf/y) of LNG to India. The country is also exploring the possibility of investing more in the Sakhalin I LNG project.

Long-term growth in demand for LNG remains unclear however, as price is an issue of contention in India and increasing domestic natural gas production is expected from eastern offshore fields. Industry analysts note that Indian companies appear unwilling to commit to long-term LNG supply contracts at international prices. While negotiations are currently underway for several long-term LNG supply deals, whether or not India's bids will be accepted is questionable in light of the low prices that India has offered to pay. Instead, India is becoming an important destination for spot LNG cargoes.

Electricity

India currently suffers from a major shortage of electric generating capacity.

In 2006, India had 144 gigawatts (GW) of installed electric capacity and generated 703 billion kilowatt hours. Nearly all power in India is generated with conventional thermal sources, which produced over 80 percent of electricity in 2006. Hydroelectricity has been a consistent source of power in India, accounting for nearly 16 percent of power generated in 2006. Finally, nuclear energy produced roughly 2 percent of electricity during the same year, while geothermal and other renewable sources accounted for as little as 1 percent.



Electricity Shortages

India suffers from a severe shortage of electric capacity. According to the World Bank, roughly 40 percent of residences in India are without electricity. In addition, blackouts are a common occurrence throughout the country's main cities. The World Bank also reports that one-third of Indian businesses believe that unreliable electricity is one of their primary impediments to doing business. Further compounding the situation is that total demand for electricity in the country continues to rise and is outpacing increases in capacity. Adequate additional capacity has failed to materialize in India in light of market regulations, insufficient investment in the sector, and difficulty in obtaining environmental approval and funding for hydropower projects. In addition, coal shortages are further straining power generation capabilities.

In order to address this shortfall, the Indian government has set the goal of adding 90,000 MW of additional electric generation capacity by 2012. In light of these targets, the private sector is beginning to step up investment in the sector. For example, UK-based Hinduja Group, which already operates several power plants in the country, has pledged \$15 billion towards the addition of 10,000 MW of capacity over the next several years. The country also grapples with electricity efficiency issues. In order to improve efficiency standards, the Energy Conservation Act was passed in 2002, which established the Bureau of Energy Efficiency and has sought to promote efficient use of energy and labeling of energy-intensive products.

It is also possible to import some electricity into India, as the country's power grid is interconnected with the grids in Nepal and Bhutan. This has allowed for the export of surplus electricity to India, however, this is not likely to prove sufficient to make up for India's lack of electric generation capacity.

Conventional Thermal Power Generation

Conventional thermal-generated power accounted for 81 percent of electricity in India in 2005. Of these sources, coal is by far the most important fuel source for power generation, with roughly 70 percent of electricity generated in coal-fired power plants. India is both the third-largest consumer and third-largest producer of coal in the world, and although the country can supply the bulk of its needs domestically, it is currently a net importer of coal. In spite of the sector's heavy reliance on coal, natural gas is becoming increasingly important in the Indian electric sector due to environmental considerations, quality concerns pertaining to the steel industry, and supply constraints surrounding coal. Although the sector's reliance on coal is unlikely to wane significantly, the power industry is largely driving the demand for natural gas in the country. Reliance Industries is building the world's largest natural gas-fired power plant at Dadri in Uttar-Pradesh, which is expected to have a capacity of 3,500 MW. The Hazira plant in Gujarat was converted to natural gas in 2002, and the Dabhol plant will run on natural gas once fully completed.

Nuclear Power Generation

Nuclear power holds a great deal of potential in India and the government is increasingly relying

on its development to hit its power generation targets. The country has recently established a civil nuclear cooperation deal with the United States. Internationally, controversy has historically surrounded India's nuclear program in light of the country's refusal to sign the Nuclear Nonproliferation Treaty (NPT) and its 1974 nuclear weapons test. The U.S.- India civil nuclear energy cooperation deal, signed in July 2005, is no exception. Also known as the "123 Agreement", the deal allows for civil nuclear trade between the U.S. and India with the goal of increasing India's installed nuclear power generation capacity.

In light of the deal, the Indian government has set its nuclear generation target at 40,000 MW by 2020, already showing an increase from its original goal of 20,000 MW. India currently has 14 nuclear reactors in commercial operation with more planned. Recently, India bought six nuclear reactors from Areva of France and four from Rosatom of Russia. They are slated for the Maharashtra and Tamil Nadu nuclear projects. Combined, the ten new reactors will add 11,000 MW of electric capacity to the country.

In addition, in September 2008, India and France also signed a civil nuclear energy cooperation deal that will further enhance India's future nuclear energy generation capabilities.

Hydropower and Other Renewables

As part of India's goal of diversifying its sources of electric power generation and increasing the country's capacity, increased use of hydroelectric power is also included in the government's plans. Hydropower could reportedly provide a great deal of additional capacity in India. Due to its environmental advantages and the country's lack of electric supply, international organizations such as the World Bank are providing funding for a variety of hydroelectric projects around the country. However, lack of reliability and environmental and community concerns surrounding construction may make it difficult to fully capitalize upon this domestic energy resource.

Geothermal, solar, and wind power hold little importance in electric power generation in the country and are unlikely to displace any of the other fuel sources in the near future. Although, the government would like the share of renewables in electricity production to increase.

Profile

Energy Overview

Proven Oil Reserves (January 1, 2009E)	5.6 billion barrels
Oil Production (2007)	880,000 barrels per day, of which 79% was crude oil.
Oil Consumption (2007E)	2.8 million barrels per day
Proven Natural Gas Reserves (January 1, 2009E)	38 trillion cubic feet
Natural Gas Production (2007E)	1,119 billion cubic feet
Natural Gas Consumption (2007E)	1,473 billion cubic feet
Recoverable Coal Reserves (2005E)	62,300 million short tons
Coal Production (2007E)	528.5 million short tons
Coal Consumption (2007E)	578.6 million short tons
Electricity Installed Capacity (2006E)	144 gigawatts
Electricity Generation (2007E)	665 billion kilowatt hours
Electricity Consumption (2006E)	517 billion kilowatt hours
Total Energy Production (2006E)	17.7 quadrillion Btus*

Total Energy Consumption (2004E)	12.4 quadrillion Btus*, of which Coal (53%), Oil (31%), Natural Gas (8%), Hydroelectricity (6%), Nuclear (1%), Other Renewables (1%)
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Total Per Capita Energy Consumption (2006)	15.9 million Btus
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Energy Intensity (2006) 7,500 Btu per \$2000-PPP**

Environmental Overview

Energy-Related Carbon Dioxide Emissions (2006)	1,300 million metric tons
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Per-Capita, Energy-Related Carbon Dioxide Emissions (2006)	1.16 metric tons
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Carbon Dioxide Intensity (2006)	0.55 Metric tons per thousand \$2000-PPP**
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Oil and Gas Industry

Organization	Petroleum: Oil and Natural Gas Corporation (ONGC); Oil India Ltd. (OIL); Indian Oil Corporation (IOC); Reliance Industries (private). Natural Gas: Gas Authority of India Ltd (GAIL)
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Major Oil/Gas Ports	Oil - Bombay, Cochin, Haldia, Kandla, Madras, Vizag; LNG – Hazira, Dahej
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Foreign Company Involvement	BG International, BP, Cairn Energy, Marubeni, Niko Resources, Petronas, Shell
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Major Refineries (capacity, bbl/d)	Reliance Petroleum: Jamnagar (660,000). IOC: Koyali (185,100), Mathura (156,000), Panipat (120,000). Mangalore Refinery and Petrochemicals Ltd: Mangalore (180,000). Hindustan Petroleum Corporation: Vishakapatnam (164,250), Mahul (132,000). Kochi Refineries Ltd: Ambalamugal (152,000). Chennai Petroleum Corporation: Madras (130,660). Bharat Petroleum Company Ltd: Mahul (120,000).
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* The total energy consumption statistic includes petroleum, dry natural gas, coal, net hydro, nuclear, geothermal, solar, wind, wood and waste electric power.

**GDP figures from Global Insight estimates based on purchasing power parity (PPP) exchange rates.

Links

EIA Links

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[U.S. State Department Background Notes on India](#)

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Foreign Government Agencies

[India's Ministry of Petroleum and Natural Gas](#)

[India's Department of Commerce](#)

[India's Ministry of External Affairs](#)

Oil and Natural Gas

[Gas Authority of India Ltd \(GAIL\)](#)

[Indian Oil Corporation \(IOC\)](#)

[Oil and Natural Gas Corporation \(ONGC\)](#)

[ONGC Videsh](#)

[Oil India Ltd \(OIL\)](#)

[Reliance Industries Ltd](#)

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World Gas Intelligence

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